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DOCUMENTATION FOR PROGRAMS USED TO
PROVIDE POINT ESTIMATES FOR EVALUATING
THE STATUS OF PORPOISE STOCKS IN THE
EASTERN TROPICAL PACIFIC

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POINT ESTIMATES FOR EVALUATING THE STATUS OF
PORPOISE STOCKS IN THE EASTERN TROPICAL PACIFIC

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INTRODUCTION

This report is intended to be a user guide and documentation for the various programs used to provide point estimates for the National Marine Fisheries Service 1979 status of porpoise stocks in the eastern tropical Pacific (Smith, 1979). These same programs have been used to provide estimates for subsequent hearings and environmental impact statements. It is anticipated that further estimates will be desired as parameter estimates become refined and updated. Since all programming was done in A.P.L. (A Programming Language), this report is intended as a guide on how to access and run these programs for persons with limited familiarity with A.P.L.

DOCUMENTATION

In order to facilitate running of these programs by persons unfamiliar with A.P.L., command files for the INFONET computing system have been written to execute these programs. Thus, all that needs to be done to execute these programs is to edit these command files to specify values for the input parameters that one wishes to change and then run the command file like any other INFONET command file.¹

In the Status of Porpoise Stock Workshop (Smith, 1979), calculations were made for 22 different stocks of porpoise. (Some stocks are defined as the sum of two or more other stocks.) In order to facilitate programming and ease of execution, each stock has been assigned a number. In most instances specification of input parameters and output is done by reference to these numbers. The 22 stocks and their corresponding reference number are listed in Table 1.

The full process of the evaluation of the status of the stocks requires

¹Note, if these programs are transferred to another computing system, the execution of these programs will be the same as the steps within the INFONET command files, except for accessing the A.P.L. interpreter which is system dependent. Also, the di-graph system for the A.P.L. character set will likely be different.

three basic sets of calculations:

1. calculations of current abundance;
2. calculations of pre-exploitation abundance;
3. calculations of future abundance based on observed or anticipated kills.

Calculations from step 1 are necessary for the calculations of step 2 and calculations from step 1 and 2 are necessary for step 3. Since multiple calculations of step 2 may be desired for any set of calculations in step 1 and similarly for step 3, command files have been provided that perform each step separately as well as combination so step 1 and 2 and steps 1, 2 and 3. The name of the command files and their intended purpose are provided in Table 2. A listing of each command file is provided in Appendix I.

The basic structure of the command file is: 1) to access the A.P.L. interpreter, 2) load the necessary workspace (i.e. the disk area where both the programs and variables are stored), 3) change the value of any input parameter from that currently stored in the loaded workspace, 4) execute the necessary programs, and 5) save the workspace under a different name. When a workspace is saved in A.P.L., the most recent values for each variable are saved. By saving the workspace after a set of calculations, the workspace can then be accessed later for further calculations without having to respecify the changes that have been made or to re-do the calculations. If it is known that the workspace will not be needed for further calculations, the save line should be eliminated from the command files. Do not save the results of runs under the name CSTATUS or the default values given for the variables in this manual will be changed. (Workspace names in A.P.L. on the INFONET system can be any combination of letters and numbers up to eight characters in length but always beginning with a letter character.).

Each of the three basic set of calculations for evaluating the status of the stocks is performed by a different program. Running a program in A.P.L. is done by simply typing the name of the program followed in some instances by vector of numbers or what is known as a right argument. The right argument is used internally by the program as a value of one of the variables within the program. The program BACK which calculates the pre-exploitation abundance and the program FOR which calculates future abundances, use a right argument to specify for which stocks calculations and output are desired. Thus, if line 200 in the command file DBAC.CO read:

200 BACK 2 5

Calculations of pre-exploitation abundance would be performed for the northern-off-shore spotted and the eastern spinner stocks. (Note that a space is required between the name of the function and the first reference number and between each subsequent number.) Calculations for all 22 stocks can be obtained by typing:²

²For the 22 stocks listed in Table 1, calculations of pre-exploitation abundance were only performed for 10 stocks by the workshop and subsequent calculations of future abundances have only been performed on 12. The program species ignores those stocks for which all elements for

200 SPECIES \$I 22

Since the calculation of current abundance requires relatively little computer time (about 20 SRU on the INFONET system), the program CURRENT which performs these calculations provides results for all stocks and does not require a right argument. Specification of a right argument for this program will result in non-execution of the program.

There are two basic types of parameters needed to perform these calculations: 1) parameters whose value applies to all species, and 2) parameters for which specific values are required for each stock. Depending upon the particular parameter, the corresponding A.P.L. variable may be a scalar, vector, or a 2 dimensional array. Any parameter which requires a different value for each stock has a corresponding A.P.L. variable which is a vector or a 2 dimensional array. If the A.P.L. variable is a vector, then the length of the vector is 22 and the i^{th} element of the vector is the value for the i^{th} stock as numbered in Table 1. Similarly, if the A.P.L. variable is a matrix, the i^{th} row refers to the values for the i^{th} species. For example, the A.P.L. vector INJURY refers to the species' specific serious injury rate used in calculating the 1959 to 1972 kills and the second element of this vector (i.e. INJURY [2]) represents the injury rate for the northern off-shore spotted stock. For species for which a parameter does not apply, the value of the corresponding element(s) in the A.P.L. variable should be specified as zero.

In order to perform the calculations for evaluating the status of the stocks, a large number of variables need to be specified. Tables 3, 4 and 5 provide a list and description of the A.P.L. variables that are needed to run the programs CURRENT, BACK and FOR. The values for each variable as stored in workspace CSTATUS are listed in Appendix II. The user of these programs and command files only needs to specify values for variables that he wishes to change in the workspace which he accesses.

Two A.P.L. variables need to be discussed in more detail. The variable N79 is the vector of current abundance and NEVEC is the vector of pre-exploitation abundance. N79 is needed for calculating pre-exploitation abundance, and NEVEC and N79 are both needed for calculating future abundances. N79 is generated by the program CURRENT and NEVEC is generated by the program BACK. (Note that the value of NEVEC for a stock is generated by the most recent calculation of pre-exploitation abundance that has been done by the program). However, the values for these variables can also be supplied by the user like any other variable and the value of these variables are saved when a workspace is saved. Thus, it is not necessary to repeat the calculations of current abundances to explore alternative estimates for the kill parameters calculating pre-exploitation abundances and similarly for future abundances. For example, if one wants to explore the effect of a set of different possible projected forward kills, one could run the command file DQUOTA.CO and save the results in some workspace, say CXX. The values of N79 and NEVEC are now saved in CXX. By then executing the command file DFOR.CO but loading workspace CXX instead of CSTATUS and specifying a second set of

their corresponding row in the matrix KTOTAL equals zero. Similarly, the program FOR ignores all stocks for which all elements for their corresponding row in the matrix KMAT equal zero.

forward kill estimates between lines 40 and 200, new future abundances can be calculated without having to repeat the calculations of current and pre-exploitation abundance.

The program BACK calculates pre-exploitation abundances for a range of values for the maximum net reproductive level and the shape parameter for the density dependent response (i.e., the parameter Z in Smith, 1979). Results are calculated for all combinations of the values of RVEC and EXPVEC. Note that the set of pre-exploitation abundances corresponding to the value of the last elements of RVEC and EXPVEC are stored in the vector NEVEC. Also the values of the last elements of RVEC and EXPVEC are used in the program FOR for the value of the maximum net productivity level and shape parameter in calculating future abundances.

There are two options available for estimating the early kills from 1959 to 1972 using BACK. The two options available are to use the algorithm for estimating the early kills developed by Lo and Smith (1979)³ or to specify directly a matrix of kills for these years in the variable KEARLY. The option which is used is controlled by the character vector named KILLMODEL. If this vector is specified as 'LO', the algorithm of Lo and Smith is used. If this vector is specified as 'DIRECT,' the direct option is used.

³The algorithm in Lo and Smith (1979) has been slightly modified to allow the number of years it took for the proportion backdown to reach the estimated 1964 level to be variable. The A.P.L. variable BACKDOWN determines the number of years. Between the years 1959 and 1959 plus the value of BACKDOWN minus 1, the proportion backdown is assumed to have increased linearly from the estimated 1959 level to the estimated 1964 levels. For the years 1959 plus BACKDOWN to 1964, the proportion backdown is assumed to equal the estimated 1964 value.

Table 1. The 22 stocks and their corresponding reference number used by the programs for calculating their status.

<u>Stockname</u>	<u>Number</u>
Coastal spotted	1
Northern offshore spotted	2
Southern offshore spotted	3
Offshore spotted	4
Eastern spinner	5
Northern whitebelly spinner	6
Costa Rican Spinner	7
Southern whitebelly spinner	8
Northern common	9
E. central common	10
W. central common	11
Central tropical common	12
Southern common	13
Northern striped	14
E. central striped	15
W. central striped	16
Central tropical striped	17
Southern striped	18
Fraser (Aircraft area)	19
Fraser (outside, north)	20
Fraser (outside, south)	21
Fraser (all areas)	22

Table 2. The name and purpose of the command files for executing the various steps in evaluating the status of the stock.

Command File <u>NAME</u>	<u>Purpose</u>
DCUR.CO	Calculates current abundance
DBAC.CO	Calculates pre-exploitation abundance
DFOR.CO	Calculates future abundances
DSTATU.CO	Calculates a set of current abundances which are then used to calculate pre-exploitation abundances
DQUOTA.CO	Calculates a set of current abundances which are used to calculate pre-exploitation abundance and both sets of calculations are then used to calculate future abundances

Table 3. Name and description of the A.P.L. variables needed to obtain estimates of current abundance by the program CURRENT.

<u>Name</u>	<u>Shape</u>	<u>Description</u>
ASPECIES	22x5	This variable corresponds to parameter A_{ik} in Smith (1979). The i^{th} row of the matrix is the area occupied by the species of the i^{th} stock in the three geographical areas. Columns 1 and 2 are redundant and are the area occupied within the region searched by the plane. Columns 3 and 4 are also redundant and equal the area north of the equator occupied by the species of the i^{th} stock. Column 5 is the area not searched by the airplane south of the equator.
ASTOCK	22x5	This variable corresponds to the parameter A_{ijk} in Smith (1979). The i^{th} row of the matrix equals the areas occupied by the j^{th} stock within the various sub-areas. Column 1 is for the area occupied by the stock within the area searched by the plane which does not overlap the boundary of any other stock for that species. Column 2 is for the area occupied by the stock within the plane area which overlaps another stock of the same species. Columns 3 and 5 are like column 1 except for the areas not searched by the plane north and south of the equator. Column 4 is like column 2 except that it is for the area north of the equator not searched by the plane.
ATOTAL	3	ATOTAL is a three element vector of the total area occupied by the target species within the three geographical subregions. Element 1 is the area surveyed by the plane. Element 2 is the area not searched by the plane north of the equator. Element 3 is the area not searched south of the equator.
DENO	1	This variable is the density of schools in the area not searched by the plane.
DENP	1	This variable is the density of schools in the area searched by the plane.

Table 3-Cont'd

<u>Name</u>	<u>Shape</u>	<u>Description</u>
0	22x5	This variable is the proportion of a species that belongs to a stock for the five areas of the variable ASTOCK. As such columns 1, 3, and 5 should equal 1 while i^{th} elements of columns 2 and 4 are the proportion of the species of the i^{th} stock which is of the i^{th} stock in the areas of overlap within the area searched by the plane and the nonplane area north of the equator respectively.
P	22x5	This variable corresponds to the P_{ik} in Smith (1979). The i^{th} row is the species proportion of the species for the i^{th} stock within the 3 geographical areas. The columns labels are the same as for ASPECIES.
SCHOOL	1	This variable is the estimated mean school size.
TAR	1	This variable is the proportion of porpoise schools which belong to target species.

Table 4. Name and description of the A.P.L. variables used to calculate pre-exploitation abundances using the program BACK.

<u>Name</u>	<u>Shape</u>	<u>Description</u>
EXPVEC	Variable	This vector is the range of values for the shape parameter (Z) for the density dependent response over which calculations of pre-exploitation abundances will be performed.
KILLMODEL	--	This is a character vector which determines which option will be used for estimating the kills from 1959 to 1972. This variable should either be specified as 'LO' or 'DIRECT'. (See text page for further explanation).
KTOTAL	22x6	This variable is a matrix of the total kill (including serious injuries) for the years 1973 to 1978. This i^{th} row is the estimated kills for the i^{th} stock and the j^{th} column is the estimated kill in year $1972 + j$.
N79	22	This variable is the vector of current abundances. The i^{th} element is the estimated abundances of the i^{th} stock. (See text page for further discussion).
RVEC	variable	This vector is the range of values for the maximum net rate of increase over which calculations of pre-exploitation abundances will be performed. Note that calculations for all combinations of RVEV and EXPVEC will be done.

Variables Needed for the Kill Algorithm of Lo and Smith

BACKDOWN	1	This variable is the number of years over which it took the proportion backdown to reach the proportion estimated in 1964. (See footnote 3).
CRE	1	This variable is the estimated ratio of the kill per set in successful sets that did not use backdown to the kill per set in successful sets that used backdown.
INJURY	22	This vector is the estimated stock specific serious injury rate. The i^{th} element is the estimate for i^{th} stock.

Table 4-Cont'd

<u>Name</u>	<u>Shape</u>	<u>Description</u>
PE	5	This vector is the estimated proportion of successful sets in which backdown was employed in the years 1959, 1967, 1966, 1968 and 1972.
RSE	2	This vector is the estimated kill rate in successful sets using backdown. The first element of the vector is estimated kill-per-set for vessels under 600 tons and the second element is the estimated rate for vessels over 600 tons.
RUE	2	This variable is the same as RSE except that it is estimated kill-per-set in unsuccessful sets.
SETS	14x2	This matrix is the estimated number of successful sets by vessel class for the years 1972 to 1959. The i^{th} row of the matrix is the number of sets in year 1973 minus i . Column 1 is the estimated number of sets for vessels less than 600 tons and column 2 is the estimated number for vessels over 600 tons.
SETU	14x2	This variable is similar to SETS except it is for the estimated number of unsuccessful sets by vessel class.
SPOR	22	This vector is the estimated proportion of the total kill for the years 1959 to 1972 which belongs to a particular stock. The i^{th} element of the vector is the estimate for the i^{th} stock. (Note, the proportioning of the kills between eastern spinner and northern whitebelly spinner to conform to the procedure adopted by the workshop is taken care of in the sub-program SET).

The Variable Needed for the DIRECT Option for the 1959-1972 Kills

KEARLY	22x14	This matrix is the estimated number of porpoise killed by stock for the years 1959-1972. The i^{th} column is the kill for the i^{th} stock. The j^{th} column is the estimate for year 1958 + j .
--------	-------	--

Table 5. Name and description of the A.P.L. variables needed to obtain estimates of future abundances by the program FOR.

<u>A.P.L. Name</u>	<u>Shape</u>	<u>Description</u>
FKMAT	22xK	This variable is the matrix of future kills. Each row represents the kill of the i^{th} stock. The j^{th} column represents the kill in year 1978 + j. The number of columns K determines for how many years calculations will be done.
EXPVEC	Variable	See Table 4. Note that the value of the last element of this vector is used for calculating future abundance.
N79	22	This variable is the vector of current abundance. The i^{th} element is the abundance of the i^{th} stock. (See text for further discussion of this variable).
NEVEC	22	This variable is the vector of pre-exploitation. (See text for further discussion of this variable).
RVEC	Variable	See Table 4. Note that the value of the last element of this vector is used for calculating future abundances.

LITERATURE CITED

- Lo, N. and T. Smith. 1979. Estimation of incidental mortality of porpoise associated with U. S. yellowfin tuna purse seine fishery from 1959-1972 working paper, SOPS/79/27, Status of Porpoise Stocks Workshop, Southwest Fisheries Center, La Jolla, California 92038.
- Smith, T. 1979. Report of the status porpoise stocks workshop (August 27-31, 1979, La Jolla, California) SWFC Admin. Report No. LJ-79-41, 120 pp.

Appendix I : Listing of command files.

```
!list dcur.co
1      !switch $
2      !advance 1
3      !limit use:200
4      !ap1
5      t
6      )load cstatus
7      current
8      )save cstatus1
9      )return
10     !switch,close

!list dbac.co
10     !switch $
11     !limit use:200
12     !ap1
13     t
14     )load cstatus
15     expvec@2.4 3.5
200    back $i22
201    )save cstatus2
202    )return

!list dfor.co
10     !switch $
11     !limit use:200
12     !ap1
13     t
14     )load cstatus
200    for $i22
201    )save cstatus3
202    )return

!list dstatu.co
10     !switch $
11     !limit use:200
12     !ap1
13     t
14     )load cstatus
15     tar@.7105
16     killmodel@'direct'
17     rvec@.02 .04 .06
200    current
201    back $i22
202    )save cstatus4
203    )return

!list deuota.co
10     !switch $
11     !limit use:200
12     !ap1
13     t
14     )load cstatus
15     killmodel@'lo'
16     backdown@3
17     incurr@21@.048
200    current
201    back $i22
202    for $i22
203    )save cstatus5
204    )return
```

Appendix II : Listing of variables used by CURRENT.

ASPECIES				
1686382	1686382	2295384	2295384	758476
1686382	1686382	2295384	2295384	758476
1686382	1686382	2295384	2295384	758476
1686382	1686382	2295384	2295384	758476
1679802	1679802	2489446	2489446	797068
1679802	1679802	2489446	2489446	797068
1679802	1679802	2489446	2489446	797068
1679802	1679802	2489446	2489446	797068
1654933	1654933	1726622	1726622	142379
1654933	1654933	1726622	1726622	142379
1654933	1654933	1726622	1726622	142379
1654933	1654933	1726622	1726622	142379
1654933	1654933	1726622	1726622	142379
1654933	1654933	1726622	1726622	142379
1680484	1680484	1943987	1943987	993913
1680484	1680484	1943987	1943987	993913
1680484	1680484	1943987	1943987	993913
1680484	1680484	1943987	1943987	993913
1680484	1680484	1943987	1943987	993913
1686382	1686382	2295384	2295384	758476
1686382	1686382	2295384	2295384	758476
1686382	1686382	2295384	2295384	758476
1686382	1686382	2295384	2295384	758476

ABLOCK				
155491	0	44326	0	0
1244164	0	2251058	0	112677
286727	0	0	0	645799
1530891	0	2251058	0	758476
582764	704504	287204	599438	0
14353	704504	1602804	599438	0
38614	0	0	0	0
339567	0	0	0	797068
149128	0	401329	0	0
1013799	0	126447	0	0
3832	0	1007297	0	0
1017631	0	1133744	0	0
488173	0	191549	0	142379
220904	0	307348	0	0
1027023	0	310065	0	0
0	0	840342	0	0
1027023	0	1150407	0	0
432557	0	486232	0	993913
1686382	0	0	0	0
0	0	2295384	0	0
0	0	0	0	758476
1686382	0	2295384	0	758476

Appendix II : Listins of variables used by CURRENT.

ATOTAL
1750334 2907759 1080122

DEND
0.00797

DENP
0.01202

O				
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0.5161	1	0.3663	1
1	0.4839	1	0.6337	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1

P				
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0.5161	1	0.3663	1
1	0.4839	1	0.6337	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1
1	0	1	0	1

SCHOOL
201

TAR
0.7105

Appendix II : Listing of variables used by BACK.

EXPVEC
2.4

KILLMODEL
1.0

KTOTAL					
4423	24	0	0	166	0
130988	95009	105407	47434	22428	19216
17664	0	2371	22941	378	1036
148652	95009	107778	70375	22806	20252
32036	25915	45279	8695	5016	2263
32943	47476	34333	20472	4540	4212
0	0	0	0	0	0
16504	0	2330	17831	468	146
7713	0	9	460	432	512
0	0	0	0	0	0
0	0	0	0	0	0
21948	4969	3164	7110	17661	2452
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
65	163	1056	154	32	517
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0
0	0	0	0	0	0

M79		
193220.753	3182000	638674.716 3820532.03
328654.99	486555.217	9220.479
264878.298	216923.185	450296.171
398100.056	848396.227	477147.558
50597.332	147233.103	66096.971
213330.074	483021.24	2704.133
19526.701	14383.916	34180.62

KVEC
0.04

BACKDOWN
6

CRE
2.34

INJURY			
0	0.048	0	0.048
0.048	0.018	0	
0	0	0	
0	0.048	0	
0	0	0	
0	0	0	
0	0	0	

Appendix II : Listing of variables used by BACK.

	PE			
0	0.96	0.8	0.89	0.91

	RSE	
69.12		39.26

	RUE	
5.55		0.5

	SETS
102	0
1351	0
2707	48
1479	5
1897	10
3808	39
5145	26
4568	37
3234	1
2896	190
4812	1722
3975	3228
1919	2327
2855	4699

	SETU
66	0
1008	0
2613	56
1640	17
1811	21
2715	58
2401	30
1684	25
813	3
986	60
1330	215
869	484
645	332
944	744

Appendix II : Listing of variables used by BACK.

[illegible][illegible]

Appendix II : Listing of variables used by FOR.

FKMAT				
124	26	0	0	0
11865	11379	14254	14254	14254
498	475	1654	1654	1654
0	0	0	0	0
1253	638	0	0	0
2310	2581	1726	1726	1726
0	0	0	0	0
176	194	694	694	694
4474	1452	1678	1678	1678
0	0	0	0	0
0	0	0	0	0
707	165	2374	2374	2374
2669	692	1788	1788	1788
440	266	280	280	280
0	0	0	0	0
0	0	0	0	0
141	47	545	545	545
57	18	1127	1127	1127
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0
0	0	0	0	0

N79		
193220.753	3182000	638674.716 3820532.03
328654.99	486555.217	9220.479
264878.298	216923.185	450296.171
398100.056	848396.227	477147.558
50597.332	147233.103	66096.971
213330.074	483021.24	2704.133
19526.701	14383.916	34180.62

NEVEC				
459700	5059800	672000	0	1236000 627700
0	293100	223000	0	0
956900	0	0	0	0
214900	0	0	0	0
0				

RVEC
0.04

Appendix III : Listings of Programs.

```

VBACK[0]V
[0]  BACK N;COUNT;SPNUM;IRE;SPE;KLATEE;CRATIO;LOKILL;RU;RS;P;RMA
    X
[1]  'WORKSPACE'
[2]  )WSID
[3]  ''
[4]  COUNT+1
[5]  N+,N
[6]  FRONTA
[7]  ''
[8]  +LOOPX\X/KILLMODEL*(P KILLMODEL)*'LO'
[9]  CRATIO+CRE
[10]  RS+RSE
[11]  RU+RUE
[12]  P+PE
[13]  LOKILL+QMAKEKILL
[14]  LOOP:SPNUM+N[COUNT]
[15]  +LOOP1X\0=+/KTOTAL[SPNUM;]
[16]  6 1P' '
[17]  'CALCULATIONS OF THE BACK ESTIMATES FOR THE ' ;STOCKNAME[SPNU
    M; ]
[18]  ''
[19]  SET
[20]  FRONTS
[21]  ESTL
[22]  LOOP1: +LOOPX\ (PN) >COUNT+COUNT+1

```

```

VCURRENT[0]V
[0]  CURRENT ;A;N;D
[1]  A+ASTOCK+ASPECIES
[2]  A[;1 2]+A[;1 2]*XATOTAL[1]
[3]  A[;3 4]+A[;3 4]*XATOTAL[2]
[4]  A[;5]+A[;5]*XATOTAL[3]
[5]  D+ (PA)PD+(2PDENP),3PDENO
[6]  N+SCHOOLXTAR X+/PX0XAXD
[7]  FRONTEND
[8]  OUT
[9]  N79+N

```

```

VDBACKCAC[0]V
[0]  Z+DBACKCAC ;REP;ZS;A;COUNT1;COUNT;X;Y;Z;K;ZZ;NEG1;NEG
[1]  K+QKILL
[2]  NEG+1
[3]  REP+MAKEREP+LYP1+Y+PKILL
[4]  ZZ+NEG1+100+Z+1PNEG+((Z+INITIAL)/X/(1+REP))++/KILLX(1+REP*.5
    )/8(X+91+REP)
[5]  COUNT+0
[6]  LOOP1:ZZ+(-.5XK[COUNT])+(ZZ-.5XK[(COUNT+1+COUNT)])X1+RMAXX1-
    (ZZ+NEG1)*EXP
[7]  +LOOP1X\ (COUNT) (Y
[8]  ZZ+ZZ-INITIAL
[9]  COUNT1+1
[10]  LOOP2:COUNT+0
[11]  LOOP3:Z+Z,ZS+(-.5XK[COUNT])+(Z[COUNT]-.5XK[(COUNT+1+COUNT)])
    X1+RMAXX1-(Z[COUNT+1]+NEG)*EXP
[12]  +LOOP3 X\ (COUNT) (Y
[13]  +OUTX\ X/EGACCURACY|ZS+(-1+Z)-INITIAL
[14]  NEG+NEG-ZS+(ZS-ZZ)/A+NEG-NEG1
[15]  NEG1+A+NEG1
[16]  ZZ+ZS
[17]  Z+NEG
[18]  +LOOP2X\ (COUNT1+COUNT1+1) (ITERATIONS
[19]  'DBACKCAC FAILED TO CONVERGE WITHIN THE SPECIFIED NUMBER OF
    '
[20]  'ITERATIONS'
[21]  +0
[22]  OUT;'DBACKCAC ITERATED ' ;COUNT1;' TIMES'
[23]  Z+0Z

```


Appendix III : Listing of Programs.

```

VDFORECAC[0]V
[0]  Z←DFORECAC NEG;COUNT;R
[1]  COUNT←1
[2]  RCUR←0F0
[3]  Z←,INITIAL
[4]  LOOP;Z←Z,(-.5XFKILL[COUNT])+(Z[COUNT]-.5XFKILL[COUNT])XK+1+R
      MAXX1-(Z[COUNT]÷NEG)XEXP
[5]  RCUR←RCUR,R
[6]  →LOOPX1(COUNT+COUNT+1)XFKILL
[7]  RCUR←RCUR,1+1XRMXX1-(Z[COUNT]÷NEG)XEXP

VESTL[0]V
[0]  ESTL;ARY;COUNT1;COUNT2;COUNT3;Y;D;B;RS;F;CRATIO;RU;KILL;EXP
      RE;INITIAL;RMAX;NE
[1]  →SKIP3X1X/KILLMODEL≠(FKILLMODEL)F'LO'
[2]  0←0 5 F0
[3]  KILL←SPEXLOKILL
[4]  KILL←KILLX1+IRE
[5]  RETURN; →SKIP1X1X/KILL=0
[6]  'THE EARLY KILLS ARE;'
[7]  Y←1973-1FKILL
[8]  '   YEAR      NUMBER KILLED'
[9]  '16,F18.2'+(Y;KILL)
[10] SKIP1;KILL←KLATEE,KILL
[11] RVEC←,RVEC
[12] EXPVEC←,EXPVEC
[13] INITIAL←NE+H79[SPNUM]
[14] COUNT2←1
[15] LOOP2;RE←RVEC[COUNT2]
[16] COUNT3←1
[17] LOOP3;EXP←EXPVEC[COUNT3]
[18] RMAX←RE
[19] ARY←DRACKCAC
[20] →JUMP1X1(PALL)=2
[21] 'INITIAL      ';INITIAL
[22] 'RMAX          ';RMAX
[23] 'EXP           ';EXP
[24] JUMP1; 0←0,[1]RE,EXP,(-1↑ARY+100000),R,REX(1-(R+NE÷-1↑ARY)XEX
      XP)XNE
[25] →JUMPX1RE=0
[26] →LOOP3X1(PEXPVEC)≥COUNT3+COUNT3+1
[27] 3 1F' '
[28] JUMP; →LOOP2X1(PRVEC)≥COUNT2+COUNT2+1
[29] 'INITIAL ABUNDANCE = ';NE
[30] ' '
[31] 'REP      EXP      NP(X10X5)      H79/NP      RY'
[32] 'F5.3,F8.1,F10.3,F12.3,F11.0'+(0)
[33] NEVEC[SPNUM]←-1↑ARY
[34] 0←0 5 F0
[35] 4 1F' '
[36] →0
[37] SKIP3;KILL←0KEARLY[SPNUM];
[38] 0←0 5F0
[39] →RETURN

```

Appendix III : Listing of Programs.

```

00000000
[00] FOR N;FKILL;INITIAL;COUNT;EXP;RMAX
[01] RMAX←1/ARVEC
[02] EXP←1/ARVEEC
[03] N←N
[04] COUNT←1
[05] LOOP:→SKIPX10=+/FKILL+FKMAT[N;COUNT];]
[06] 'FORWARD KILLS FOR ' ;STOCKNAME[N;COUNT];]
[07] ''
[08] →JUMPX107NER+NEVEC[N;COUNT]]
[09] 'PRE EXPLOITATION IS ASSUMED TO EQUAL CURRENT ABUNDANCE FOR
THIS STOCK'
[10] ''
[11] NER←N79[N;COUNT]]
[12] JUMP:INITIAL←N79[N;COUNT]]
[13] FORWARD
[14] 3 1 f ' '
[15] SKIP: →LOOPX1(fN)COUNT←COUNT+1

00000000
[00] FORWARD[[]]
[01] FORWARD;YEARS;FN;PCOUNT;PCUR;MNPL
[02] TIME
[03] ''
[04] 'THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORD-
ING TO'
[05] 'THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE
RATE OF '
[06] 'RECOVERY OF THE POPULATION.'
[07] ''
[08] 'THE PARAMETER VALUES USED IN THIS RUN ARE:'
[09] ' PRESENT ABUNDANCE = ' ;INITIAL
[10] ' PRE-EXPLOITATION ABUNDANCE = ' ;NER
[11] ' RMAX = ' ;RMAX
[12] ' THE EXPONENT = ' ;EXP
[13] ' THE CORRESPONDING MNPL LEVEL = ' ;MNPL+100÷(1+EXP)×1÷EXP
; ' PER CENT'
[14] MNPL←NER×MNPL÷100
[15] YEARS←YEARSTART, YEARSTART+1, FKILL
[16] ''
[17] 'THE KILL IN ' ;YEARSTART; ' IS: ' ;FKILL [1]
[18] ''
[19] 'THE QUOTA IN FUTURE YEARS IS ' ;FKILL
[20] ''
[21] FN←DFORFCAC NER
[22] 'THE RESULTS ARE:'
[23] ''
[24] ' YEARS ESTIMATED PER CENT PER CENT REFLA
CEMENT CURRENT'
[25] 'YEAR AHEAD ABUNDANCE OF MNPL OF NER YIF
LD NET REP'
[26] PCOUNT←0
[27] PLOOP:←(PCOUNT×10)+110
[28] →SKIPX1(X[10])PFN
[29] X←((PFN)-PCOUNTX10)÷X
[30] SKIP: 14,17,X5,F12.4,F8.2,F11.1,X7,F12.4,F9.4+(YEARS[X];YE-
ARS[X]-YEARSTART;PFN[X];100×FN[X]÷MNPL;100×FN[X]÷NER;FN[X]×PC
UR[X]-1;PCUR[X])
[31] PCOUNT←PCOUNT+1
[32] →PLOOPX1(1÷X)(PFN

```

Appendix III : Listing of Programs.

```

VFRONTA[0]V
[0]   FRONTA;PY;Y
[1]   60P'X'
[2]   'THE KILL MODEL IS ';$KILLMODEL
[3]   60P'X'
[4]   ''
[5]   ''
[6]   TIME
[7]   ''
[8]   ''
[9]   'THE INPUT PARAMETERS ARE;'
[10]  ''
[11]  +0X\X/KILLMODEL$(P$KILLMODEL)P'LO'
[12]  'KILL PER SET'
[13]  'VESSEL CLASS      SUCCESSFUL      UNSUCCESSFUL'
[14]  'I6,F17.4,F15.4'+(P$RSE;RSE;RUE)
[15]  ''
[16]  'THE RATIO OF KILL PER SET W/O BACKDOWN TO KILL PER SET WIT
H = ';$CRE
[17]  ''
[18]  'YEAR      PROPORTION BACKDOWN'
[19]  PY+1959 1964 1966 1968 1972
[20]  'I4,F10.4'+(PY;PE)
[21]  ''
[22]  'NOTE PROPORTION BACKDOWN FOR YEARS 1968-1971 ASSUMED TO BE
EQUAL'
[23]  ''
[24]  'THE KPROPORTION BACKDOWN REACHES THE 1964 LEVEL IN ';$BACKD
OWN ;' YEARS'
[25]  ''
[26]  'NUMBER OF SUCCESSFUL SETS (BY VESSEL CLASS)'
[27]  Y+01973-{P$SETS[;1]}
[28]  '   YEAR'
[29]  'I8'+(Y,[2]SETS)
[30]  ''
[31]  'NUMBER OF UNSUCCESSFUL SETS (BY VESSEL CLASS)'
[32]  '   YEAR'
[33]  'I8'+Y,[2]SETU

```


Appendix III : Listing of Programs.

```

VFRONTEND[0]V
[00] FRONTEND ;AA;BB;N
[10] N←PP[1]
[20] AA←(16P' '), 'PLANE NO PLANE WITH NORTH NO NORTH WITH
      SOUTH NO'
[30] OPW←130
[40] BB← ' SPECIES',60P' OVERLAP'
[50] TIME
[60] ''
[70] 'THIS FUNCTION COMPUTES THE ESTIMATED POPULATION SIZE BY ST
      OCK '
[80] ' FOR THE VARIOUS STOCKS OF PORPOISES INVOLVED IN'
[90] 'THE TUNA PURSE SEINE FISHERY'
[100] ''
[110] 'THE INPUT PARARMETERS ARE:'
[120] ' SCHOOL SIZE = ' ;SCHOOL
[130] ' PROPORTION TARGET = ' ;TAR
[140] ' THE DENSITY OF SCHOOLS INSIDE = ' ;DENP
[150] ' THE DENSITY OF SCHOOLS OUTSIDE = ' ;DENO
[160] ''
[170] 'THE TOTAL AREA OF THE VARIOUS AREA ARE'
[180] ' AIRPLANE AREA= ' ;ATOTAL[1]
[190] ' NORTH AREA = ' ;ATOTAL[2]
[200] ' SOUTH AREA = ' ;ATOTAL[3]
[210] ''
[220] 'THE MATRIX OF AREAS OCCUPIED BY EACH STOCK IS'
[230] AA
[240] BB
[250] 'I12,5F12.0'+(N;ASTOCK)
[260] ''
[270] 'THE MATRIX OF THE AREA OCCUPIED BY THEWHOLE SPECIES FOR T
      HE VARIOUS STOCKS IS'
[280] AA
[290] BB
[300] 'I12,5F12.0'+(N;ASPECIES)
[310] ''
[320] 'THE MATRIX OF CACULATED AREAS IS:'
[330] AA
[340] BB
[350] 'I12'+(N;A)
[360] ''
[370] 'THE MATRIX OF SPECIES PROPORTIONS IS'
[380] AA
[390] BB
[400] 'I12,5F12.4'+(N;P)
[410] ''
[420] 'THE MATRIX OF THE PROPORTION OVERLAP'
[430] AA
[440] BB
[450] 'I12,5F12.4'+(N,O)
[460] ''

```

```

VFRONTS[0]V
[00] FRONTS;Y
[10] →SKIP X1X/KILLMODEL/(PKILLMODEL)P'LO'
[20] 'THE SPECIES PROPORTION FOR THE EARLY KILLS = ' ;SPE
[30] 'THE INJURY RATE = ' ;IRE
[40] SKIP: 'THE POST 1972 KILLS ARE:'
[50] Y←YEARSTART-1PKLATEE
[60] ' YEAR KILL'
[70] 'I6,F10.2'+(Y;KLATEE)

```

Appendix III : Listing of Programs.

```

      VMAKEKILL[0]V
[0]  Z←MAKEKILL
[1]  PB←P[1],P[1]+(P[2]-P[1])X(1-BACKDOWN-1)+BACKDOWN-1
[2]  PB←PB,(6-BACKDOWN)P[2]
[3]  A THE ABOVE 2 LINES INSERTED TO ALLOW BACKDOWN TO REACH L964
      LEVEL IN VARIABLE NUMBER OF YEARS.
[4]  PB←(PSETS[;1])P(PB),(.5XP[2]+P[3]),(P[3]),(.5X(3XP[3])-P[2])
      , (P[4]),((P[4])X(1-(13)÷3))+P[5]X(13)÷3,P[5],P[5],(10P1)
[5]  PB[9]←.5X(P[3]+P[4])
[6]  PB[10 11 12 13]←P[4]
[7]  A THE ABOVE LINE INSERTS A REVISION OF TECHNIQUE FOR L967
[8]  KE←+(SETUX((PSETU[;1])P1)°,XRU)÷(CRATIOXSETS(1-PB)°,XRS)+S
      ETSX(PB°,XRS)
[9]  Z←KE
[10] A COMPUTES THE KILL VECTOR ACCORDING TO MODEL 1 FOR EARLY EST
      IMATES.
[11] A THE INPUT VARIABLES ARE:
[12] A P=THE PROPORTION OF SUCCESSFUL SETS IN 1959,1964,1966,1968.
[13] A SETS=MATRIX OF THE NUMBER OF SUCCESSFUL SET BY YEAR (ROWS)
      AND
[14] A VESSEL CLASS (COLUMNS).
[15] A SETU=MATRIX OF UNSUCCESSFUL SETS
[16] A RS=VECTOR OF KILL PER SET IN SUCCESSFUL SETS BY VESSEL CLAS
      S
[17] A RU=VECTOR OF KILL PER SET IN UNSUCCESSFUL SETS BY VESSEL CL
      ASS
[18] A KLATE=THE VECTOR OF KILLS FOR THOSE YEARS IN WHICH INDEPEND
      ENT
[19] A ESTIMATES ARE AVAILABLE

      VMAKEREP[0]V
[0]  Z←MAKEREP N
[1]  Z←(1-(N+NEG)XEXP)°,XRMAS

      VOUT[0]V
[0]  OUT;T
[1]  'THE RESULTS OF THIS RUN ARE'
[2]  ''
[3]  ' SPECIES CURRENT ABUNDANCE'
[4]  '30A1,E14.3'+(STOCKNAME;N)

      VSET[0]V
[0]  SET
[1]  IRF←INJURY[SPNUM]
[2]  SPE←SPOR[SPNUM]
[3]  KLATE←0KTOTAL[SPNUM;]
[4]  →SKIP X1 SPNUM=5
[5]  →0X1 SPNUM≠6
[6]  SPE←(4P SPE),10P0
[7]  →0
[8]  SKIP;SPE←(4P SPE-SPOR[6]),10P SPE

      VTIME[0]V
[0]  TIME;TS
[1]  TS←0TS
[2]  'DATE: ' ; TS[2]; '/' ; TS[3]; '/' ; TS[1]
[3]  'TIME: ' ; TS[4]; ':' ; TS[5]

```

Appendix IV : Sample output for program CURRENT.

CURRENT
DATE: 4/2/1981
TIME: 9:48

THIS FUNCTION COMPUTES THE ESTIMATED POPULATION SIZE BY STOCK
FOR THE VARIOUS STOCKS OF PORPOISES INVOLVED IN
THE TUNA PURSE SEINE FISHERY

THE INPUT PARAMETERS ARE:

SCHOOL SIZE = 201
PROPORTION TARGET = 0.7105
THE DENSITY OF SCHOOLS INSIDE = 0.01202
THE DENSITY OF SCHOOLS OUTSIDE = 0.00797

THE TOTAL AREA OF THE VARIOUS AREA ARE

AIRPLANE AREA= 1750334
NORTH AREA = 2907759
SOUTH AREA = 1080122

THE MATRIX OF AREAS OCCUPIED BY EACH STOCK IS

SPECIES	PLANE NO OVERLAP	PLANE WITH OVERLAP	NORTH NO OVERLAP	NORTH WITH OVERLAP	SOUTH NO OVERLAP
1	155491	0	44326	0	0
2	1244164	0	2251058	0	112677
3	286727	0	0	0	645799
4	1530891	0	2251058	0	758476
5	582764	704504	287204	599438	0
6	14353	704504	1602804	599438	0
7	38614	0	0	0	0
8	339567	0	0	0	797068
9	149128	0	401329	0	0
10	1013799	0	126447	0	0
11	3832	0	1007297	0	0
12	1017631	0	1133744	0	0
13	488173	0	191549	0	142379
14	220904	0	307348	0	0
15	1027023	0	310065	0	0
16	0	0	840342	0	0
17	1027023	0	1150407	0	0
18	432557	0	486232	0	993913
19	1686382	0	0	0	0
20	0	0	2295384	0	0
21	0	0	0	0	758476
22	1686382	0	2295384	0	758476

THE MATRIX OF THE AREA OCCUPIED BY THE WHOLE SPECIES FOR THE VARIOUS STOCKS IS.

SPECIES	PLANE NO OVERLAP	PLANE WITH OVERLAP	NORTH NO OVERLAP	NORTH WITH OVERLAP	SOUTH NO OVERLAP
1	1686382	1686382	2295384	2295384	758476
2	1686382	1686382	2295384	2295384	758476
3	1686382	1686382	2295384	2295384	758476
4	1686382	1686382	2295384	2295384	758476
5	1679802	1679802	2489446	2489446	797068
6	1679802	1679802	2489446	2489446	797068
7	1679802	1679802	2489446	2489446	797068
8	1679802	1679802	2489446	2489446	797068
9	1654933	1654933	1726622	1726622	142379
10	1654933	1654933	1726622	1726622	142379
11	1654933	1654933	1726622	1726622	142379
12	1654933	1654933	1726622	1726622	142379
13	1654933	1654933	1726622	1726622	142379
14	1680484	1680484	1943987	1943987	993913
15	1680484	1680484	1943987	1943987	993913
16	1680484	1680484	1943987	1943987	993913
17	1680484	1680484	1943987	1943987	993913
18	1680484	1680484	1943987	1943987	993913
19	1686382	1686382	2295384	2295384	758476
20	1686382	1686382	2295384	2295384	758476
21	1686382	1686382	2295384	2295384	758476
22	1686382	1686382	2295384	2295384	758476

Appendix IV : Sample output for Program CURRENT.

THE MATRIX OF CALCULATED AREEAS IS:

SPECIES	PLANE NO OVERLAP	PLANE WITH OVERLAP	NORTH NO OVERLAP	NORTH WITH OVERLAP	SOUTH NO OVERLAP
1	161388	0	56152	0	0
2	1291346	0	2851607	0	160460
3	297600	0	0	0	919662
4	1588946	0	2851607	0	1080122
5	607233	734085	335464	700164	0
6	14956	734085	1872130	700164	0
7	40235	0	0	0	0
8	353825	0	0	0	1080122
9	157725	0	675868	0	0
10	1072241	0	212946	0	0
11	4053	0	1696363	0	0
12	1076294	0	1909309	0	0
13	516314	0	322583	0	1080122
14	230086	0	459722	0	0
15	1069712	0	463786	0	0
16	0	0	1256959	0	0
17	1069712	0	1720745	0	0
18	450536	0	727292	0	1080122
19	1750334	0	0	0	0
20	0	0	2907759	0	0
21	0	0	0	0	1080122
22	1750334	0	2907759	0	1080122

THE MATRIX OF SPECIES PROPORTIONS IS

SPECIES	PLANE NO OVERLAP	PLANE WITH OVERLAP	NORTH NO OVERLAP	NORTH WITH OVERLAP	SOUTH NO OVERLAP
1	1.0000	0.0000	1.0000	0.0000	1.0000
2	1.0000	0.0000	1.0000	0.0000	1.0000
3	1.0000	0.0000	1.0000	0.0000	1.0000
4	1.0000	0.0000	1.0000	0.0000	1.0000
5	1.0000	0.5161	1.0000	0.3663	1.0000
6	1.0000	0.4939	1.0000	0.6337	1.0000
7	1.0000	0.0000	1.0000	0.0000	1.0000
8	1.0000	0.0000	1.0000	0.0000	1.0000
9	1.0000	0.0000	1.0000	0.0000	1.0000
10	1.0000	0.0000	1.0000	0.0000	1.0000
11	1.0000	0.0000	1.0000	0.0000	1.0000
12	1.0000	0.0000	1.0000	0.0000	1.0000
13	1.0000	0.0000	1.0000	0.0000	1.0000
14	1.0000	0.0000	1.0000	0.0000	1.0000
15	1.0000	0.0000	1.0000	0.0000	1.0000
16	1.0000	0.0000	1.0000	0.0000	1.0000
17	1.0000	0.0000	1.0000	0.0000	1.0000
18	1.0000	0.0000	1.0000	0.0000	1.0000
19	1.0000	0.0000	1.0000	0.0000	1.0000
20	1.0000	0.0000	1.0000	0.0000	1.0000
21	1.0000	0.0000	1.0000	0.0000	1.0000
22	1.0000	0.0000	1.0000	0.0000	1.0000

Appendix IV : Sample output for program CURRENT.

THE MATRIX OF THE PROPORTION OVERLAP

SPECIES	PLANE NO OVERLAP	PLANE WITH OVERLAP	NORTH NO OVERLAP	NORTH WITH OVERLAP	SOUTH NO OVERLAP
1	1.0000	0.0000	1.0000	0.0000	1.0000
2	1.0000	0.0000	1.0000	0.0000	1.0000
3	1.0000	0.0000	1.0000	0.0000	1.0000
4	1.0000	0.0000	1.0000	0.0000	1.0000
5	1.0000	0.5161	1.0000	0.3663	1.0000
6	1.0000	0.4839	1.0000	0.6337	1.0000
7	1.0000	0.0000	1.0000	0.0000	1.0000
8	1.0000	0.0000	1.0000	0.0000	1.0000
9	1.0000	0.0000	1.0000	0.0000	1.0000
10	1.0000	0.0000	1.0000	0.0000	1.0000
11	1.0000	0.0000	1.0000	0.0000	1.0000
12	1.0000	0.0000	1.0000	0.0000	1.0000
13	1.0000	0.0000	1.0000	0.0000	1.0000
14	1.0000	0.0000	1.0000	0.0000	1.0000
15	1.0000	0.0000	1.0000	0.0000	1.0000
16	1.0000	0.0000	1.0000	0.0000	1.0000
17	1.0000	0.0000	1.0000	0.0000	1.0000
18	1.0000	0.0000	1.0000	0.0000	1.0000
19	1.0000	0.0000	1.0000	0.0000	1.0000
20	1.0000	0.0000	1.0000	0.0000	1.0000
21	1.0000	0.0000	1.0000	0.0000	1.0000
22	1.0000	0.0000	1.0000	0.0000	1.0000

THE RESULTS OF THIS RUN ARE

SPECIES	CURRENT ABUNDANCE
COASTAL SPOTTED	3.409E5
NORTHERN OFF SHORE SPOTTED	5.645E6
SOUTHERN OFF SHORE SPOTTED	1.558E6
OFFSHORE SPOTTED	7.203E6
EASTERN SPINNER	1.867E6
NORTHER WHITEBELLY SPINNER	2.772E6
COSTA RICAN SPINNER	6.907E4
SOUTHERN WHITEBELLY SPINNER	1.837E6
NORTHERN COMMON	1.040E6
E. CENTRAL COMMON	2.083E6
W. CENTRAL COMMON	1.938E6
CENTRAL TROPICAL COMMON	4.021E6
SOUTHERN COMMON	2.483E6
NORTHERN STRIPED	9.182E5
E. CENTRAL STRIPPED	2.364E6
W. CENTRAL STRIPED	1.431E6
CENTRAL TROPICAL STRIPED	3.795E6
SOUTHERN STRIPED	2.831E6
FRASER (AIRCRAFT AREA)	3.005E6
FRASER (OUTSIDE,NORTH)	3.310E6
FRASER (OUTSIDE,SOUTH)	1.229E6
FRASER (ALL.)	7.544E6

Appendix IV : Sample output for Program BACK.

BACK 122
WORKSPACE
CSTATUS

THE KILL MODEL IS LO

DATE: 4/2/1981
TIME: 9:50

THE INPUT PARAMETERS ARE:

KILL PER SET	SUCCESSFUL	UNSUCCESSFUL
VESSEL CLASS 1	69.1200	5.5500
2	39.2600	0.5000

THE RATIO OF KILL PER SET W/O BACKDOWN TO KILL PER SET WITH = 2.34

YEAR	PROPORTION BACKDOWN
1959	0.0000
1964	0.8000
1966	0.8900
1968	0.9100
1972	0.9600

NOTE PROPORTION BACKDOWN FOR YEARS 1968-1971 ASSUMED TO BE EQUAL

THE KPROPORTION BACKDOWN REACHES THE 1964 LEVEL IN 6 YEARS

NUMBER OF SUCCESSFUL SETS (BY VESSEL CLASS)

YEAR	1	2
1959	102	0
1960	1351	0
1961	2707	48
1962	1479	5
1963	1897	10
1964	3808	39
1965	5145	26
1966	4568	37
1967	3234	1
1968	2896	190
1969	4812	1722
1970	3975	3228
1971	1919	2327
1972	2855	4699

NUMBER OF UNSUCCESSFUL SETS (BY VESSEL CLASS)

YEAR	1	2
1959	66	0
1960	1008	0
1961	2613	56
1962	1640	17
1963	1811	21
1964	2715	58
1965	2401	30
1966	1684	25
1967	813	3
1968	986	60
1969	1330	215
1970	869	484
1971	645	332
1972	944	744

Appendix IV : Sample output for program BACK.

CALCULATIONS OF THE BACK ESTIMATES FOR THE COASTAL SPOTTED

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0

THE INJURY RATE = 0

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	0.00
1977	166.00
1976	0.00
1975	0.00
1974	24.00
1973	4423.00

DBACKCAC ITERATED 4 TIMES

INITIAL ABUNDANCE = 340946.7788

REP	EXP	NP(X10*5)	N79/NP	RY
0.040	2.4	3.438	0.992	271

CALCULATIONS OF THE BACK ESTIMATES FOR THE NORTHERN OFF SHORE SPOTTED

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0.7

THE INJURY RATE = 0.048

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	19216.00
1977	22428.00
1976	47434.00
1975	105407.00
1974	95009.00
1973	130988.00

THE EARLY KILLS ARE:

YEAR	NUMBER KILLED
1972	299233.32
1971	186891.47
1970	333763.87
1969	334196.38
1968	174724.09
1967	189302.41
1966	273857.06
1965	325761.31
1964	257337.85
1963	150400.31
1962	134179.01
1961	275637.19
1960	149716.98
1959	12371.33

DBACKCAC ITERATED 5 TIMES

INITIAL ABUNDANCE = 5645035.485

REP	EXP	NP(X10*5)	N79/NP	RY
0.040	2.4	75.533	0.747	113547

Appendix IV : Sample output for program BACK.

CACULATIONS OF THE BACK ESTIMATES FOR THE SOUTHERN OFF SHORE SPOTTED

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0

THE INJURY RATE = 0

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	1036.00
1977	378.00
1976	22941.00
1975	2371.00
1974	0.00
1973	17664.00

DBACKCAC ITERATED 4 TIMES

INITIAL ABUNDANCE = 1557614.84

REP	EXP	NP(x10*5)	N79/NP	RY
0.040	2.4	15.905	0.979	3046

CACULATIONS OF THE BACK ESTIMATES FOR THE OFFSHORE SPOTTED

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0.7

THE INJURY RATE = 0.048

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	20252.00
1977	22806.00
1976	70375.00
1975	107778.00
1974	95009.00
1973	148652.00

THE EARLY KILLS ARE:

YEAR	NUMBER KILLED
1972	299233.32
1971	186891.47
1970	333763.87
1969	334196.38
1968	174724.09
1967	189302.41
1966	273857.06
1965	325761.31
1964	257337.85
1963	150400.31
1962	134179.01
1961	275437.19
1960	149716.98
1959	12371.33

DBACKCAC ITERATED 5 TIMES

INITIAL ABUNDANCE = 7202650.325

REP	EXP	NP(x10*5)	N79/NP	RY
0.040	2.4	90.382	0.797	121019

Appendix IV : Sample output for Program BACK.

CALCULATIONS OF THE BACK ESTIMATES FOR THE EASTERN SPINNER

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0.2334

0.2334 0.2334 0.2334 0.2619 0.2619 0.2619 0.2619 0.2619

THE INJURY RATE = 0.048

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	2263.00
1977	5016.00
1976	8695.00
1975	45279.00
1974	25915.00
1973	32036.00

THE EARLY KILLS ARE:

YEAR	NUMBER KILLED
1972	99772.94
1971	62314.96
1970	111286.41
1969	111530.65
1968	65371.77
1967	70826.15
1966	102461.66
1965	121881.27
1964	96281.12
1963	56271.20
1962	50202.12
1961	103127.69
1960	56015.54
1959	4628.64

DRACKCAG ITERATED 5 TIMES

INITIAL ABUNDANCE = 1866763.057

REP	EXP	NP(x10*5)	M79/NP	RY
0.040	2.4	25.334	0.737	38788

CALCULATIONS OF THE BACK ESTIMATES FOR THE NORTHER WHITEBELLY SPINNER

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0.0285 0.0285

0.0285 0 0 0 0 0 0 0 0

THE INJURY RATE = 0.048

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	4212.00
1977	4540.00
1976	20472.00
1975	34333.00
1974	47476.00
1973	32943.00

THE EARLY KILLS ARE:

YEAR	NUMBER KILLED
1972	12183.07
1971	7609.15
1970	13588.96
1969	13618.78
1968	0.00
1967	0.00
1966	0.00
1965	0.00
1964	0.00
1963	0.00
1962	0.00
1961	0.00
1960	0.00
1959	0.00

DRACKCAG ITERATED 4 TIMES

Appendix IV : Sample output for program BACK.

INITIAL ABUNDANCE = 2771625.402

REP	EXP	NP(x10 ⁴ 5)	N79/NP	RY
0.040	2.4	28.994	0.956	11365

CACULATIONS OF THE BACK ESTIMATES FOR THE SOUTHERN WHITEBELLY SPINNER

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0

THE INJURY RATE = 0

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	146.00
1977	468.00
1976	17831.00
1975	2330.00
1974	0.00
1973	16504.00

DBACKCAC ITERATED 4 TIMES

INITIAL ABUNDANCE = 1836763.937

REP	EXP	NP(x10 ⁴ 5)	N79/NP	RY
0.040	2.4	18.638	0.985	2532

CACULATIONS OF THE BACK ESTIMATES FOR THE NORTHERN COMMON

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0

THE INJURY RATE = 0

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	512.00
1977	432.00
1976	460.00
1975	9.00
1974	0.00
1973	7713.00

DBACKCAC ITERATED 4 TIMES

INITIAL ABUNDANCE = 1040019.796

REP	EXP	NP(x10 ⁴ 5)	N79/NP	RY
0.040	2.4	10.460	0.994	568

Appendix IV : Sample output for program BACK.

CACULATIONS OF THE BACK ESTIMATES FOR THE CENTRAL TROPICAL COMMON

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0.0372

THE INJURY RATE = 0.048

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	2452.00
1977	17661.00
1976	7110.00
1975	3164.00
1974	4969.00
1973	21948.00

THE EARLY KILLS ARE:

YEAR	NUMBER KILLED
1972	15902.11
1971	9931.95
1970	17737.17
1969	17776.09
1968	9285.34
1967	10060.07
1966	14553.55
1965	17311.89
1964	13675.67
1963	7992.70
1962	7130.66
1961	14648.15
1960	7956.39
1959	657.45

DBACKCAC ITERATED 5 TIMES

INITIAL ABUNDANCE = 848396.2271

REP	EXP	NP(X10*5)	N79/NP	RY
0.040	2.4	9.601	0.884	8716

CACULATIONS OF THE BACK ESTIMATES FOR THE CENTRAL TROPICAL STRIPED

THE SPECIES PROPORTION FOR THE EARLY KILLS = 0

THE INJURY RATE = 0

THE POST 1972 KILLS ARE:

YEAR	KILL
1978	517.00
1977	32.00
1976	154.00
1975	1056.00
1974	163.00
1973	65.00

DBACKCAC ITERATED 3 TIMES

INITIAL ABUNDANCE = 3794799.6

REP	EXP	NP(X10*5)	N79/NP	RY
0.040	2.4	37.964	1.000	154

Appendix IV : Sample output for program FOR.

FOR 122
FORWARD KILLS FOR COASTAL SPOTTED

DATE: 4/2/1981
TIME: 9:57

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 340946.7788
PRE-EXPLOITATION ABUNDANCE = 343809.625
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 124.712

THE QUOTA IN FUTURE YEARS IS 124.712 26.2 0 0 0

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEG	REPLACEMENT YIELD	CURRENT NET REP
1979	0	3.4095E5	165.13	99.2	2.7096E2	1.0008
1980	1	3.4109E5	165.20	99.2	2.5731E2	1.0008
1981	2	3.4132E5	165.31	99.3	2.3569E2	1.0007
1982	3	3.4156E5	165.42	99.3	2.1359E2	1.0006
1983	4	3.4177E5	165.53	99.4	1.9352E2	1.0006
1984	5	3.4197E5	165.62	99.5	1.7530E2	1.0005

FORWARD KILLS FOR NORTHERN OFF SHORE SPOTTED

DATE: 4/2/1981
TIME: 9:57

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 5645035.485
PRE-EXPLOITATION ABUNDANCE = 7553258.914
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 11865.456

THE QUOTA IN FUTURE YEARS IS 11865.456 11379.184 14254 14254 14254

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEG	REPLACEMENT YIELD	CURRENT NET REP
1979	0	5.6450E6	124.45	74.7	1.1355E5	1.0201
1980	1	5.7466E6	126.69	76.1	1.1059E5	1.0192
1981	2	5.8457E6	128.87	77.4	1.0742E5	1.0184
1982	3	5.9387E6	130.92	78.6	1.0417E5	1.0175
1983	4	6.0285E6	132.90	79.8	1.0078E5	1.0167
1984	5	6.1149E6	134.81	81.0	9.7275E4	1.0159

Appendix IV : Sample output for Program FOR.

FORWARD KILLS FOR SOUTHERN OFF SHORE SPOTTED

DATE: 4/2/1981
TIME: 9:57

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 1557614.84
PRE-EXPLOITATION ABUNDANCE = 1590491.284
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNFL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 498.848

THE QUOTA IN FUTURE YEARS IS 498.848 475.792 1654 1654 1654

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNFL	PER CENT OF NEQ	REPLACEMENT YIELD	CURRENT NET REP
1979	0	1.5576E6	163.07	97.9	3.0463E3	1.0020
1980	1	1.5602E6	163.34	98.1	2.8181E3	1.0018
1981	2	1.5625E6	163.58	98.2	2.6071E3	1.0017
1982	3	1.5635E6	163.68	98.3	2.5210E3	1.0016
1983	4	1.5643E6	163.77	98.4	2.4426E3	1.0016
1984	5	1.5651E6	163.86	98.4	2.3711E3	1.0015

FORWARD KILLS FOR EASTERN SPINNER

DATE: 4/2/1981
TIME: 9:59

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 1865763.057
PRE-EXPLOITATION ABUNDANCE = 2533392.582
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNFL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 1253.408

THE QUOTA IN FUTURE YEARS IS 1253.408 638.232 0 0 0

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNFL	PER CENT OF NEQ	REPLACEMENT YIELD	CURRENT NET REP
1979	0	1.8668E6	122.70	73.7	3.8788E4	1.0208
1980	1	1.9043E6	125.16	75.2	3.7777E4	1.0198
1981	2	1.9414E6	127.60	76.6	3.6657E4	1.0189
1982	3	1.9781E6	130.01	78.1	3.5431E4	1.0179
1983	4	2.0135E6	132.34	79.5	3.4130E4	1.0170
1984	5	2.0476E6	134.59	80.8	3.2766E4	1.0160

Appendix IV : Sample output for program FOR.

FORWARD KILLS FOR NORTHER WHITEBELLY SPINNER

DATE: 4/2/1981
TIME: 10:0

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 2771625.402
PRE-EXPLOITATION ABUNDANCE = 2899387.429
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 2310.84

THE QUOTA IN FUTURE YEARS IS 2310.84 2581.224 1726 1726 1726

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEQ	REPLACEMENT YIELD	CURRENT NET REP
1979	0	2.7716E6	159.18	95.6	1.1365E4	1.0041
1980	1	2.7807E6	159.70	95.9	1.0618E4	1.0038
1981	2	2.7887E6	160.16	96.2	9.9480E3	1.0036
1982	3	2.7969E6	160.63	96.5	9.2551E3	1.0033
1983	4	2.8045E6	161.06	96.7	8.6142E3	1.0031
1984	5	2.8113E6	161.46	97.0	8.0225E3	1.0029

FORWARD KILLS FOR SOUTHERN WHITEBELLY SPINNER

DATE: 4/2/1981
TIME: 10:0

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 1836763.937
PRE-EXPLOITATION ABUNDANCE = 1863803.143
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 176.064

THE QUOTA IN FUTURE YEARS IS 176.064 194.928 694 694 694

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEQ	REPLACEMENT YIELD	CURRENT NET REP
1979	0	1.8368E6	164.10	98.5	2.0322E3	1.0014
1980	1	1.8391E6	164.31	98.7	2.3166E3	1.0013
1981	2	1.8412E6	164.50	98.8	2.1216E3	1.0012
1982	3	1.8427E6	164.63	98.9	1.9900E3	1.0011
1983	4	1.8440E6	164.74	98.9	1.8702E3	1.0010
1984	5	1.8451E6	164.85	99.0	1.7613E3	1.0010

Appendix IV : Sample output for Program FOR.

FORWARD KILLS FOR NORTHERN COMMON

DATE: 4/2/1981
TIME: 10:0

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:

PRESENT ABUNDANCE = 1040019.796
PRE-EXPLOITATION ABUNDANCE = 1045989.733
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 4474.96

THE QUOTA IN FUTURE YEARS IS 4474.96 1452.528 1678 1678 1678

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEG	REPLACEMENT YIELD	CURRENT NET REP
1979	0	1.0400E6	165.56	99.4	5.6757E2	1.0005
1980	1	1.0361E6	164.94	99.1	9.3318E2	1.0009
1981	2	1.0356E6	164.86	99.0	9.8147E2	1.0009
1982	3	1.0349E6	164.75	98.9	1.0461E3	1.0010
1983	4	1.0343E6	164.65	98.9	1.1046E3	1.0011
1984	5	1.0337E6	164.56	98.8	1.1576E3	1.0011

FORWARD KILLS FOR CENTRAL TROPICAL COMMON

DATE: 4/2/1981
TIME: 10:2

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:

PRESENT ABUNDANCE = 4020721.306
PRE-EXPLOITATION ABUNDANCE = 4121684.967
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 707.4

THE QUOTA IN FUTURE YEARS IS 707.4 165.584 2374 2374 2374

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEG	REPLACEMENT YIELD	CURRENT NET REP
1979	0	4.0207E6	162.43	97.6	9.2935E3	1.0023
1980	1	4.0293E6	162.78	97.8	8.5340E3	1.0021
1981	2	4.0377E6	163.12	98.0	7.7882E3	1.0019
1982	3	4.0431E6	163.34	98.1	7.3030E3	1.0018
1983	4	4.0480E6	163.54	98.2	6.8593E3	1.0017
1984	5	4.0525E6	163.72	98.3	6.4540E3	1.0016

Appendix IV : Sample output for program FOR.

FORWARD KILLS FOR SOUTHERN COMMON

PRE EXPLOITATION IS ASSUMED TO EQUAL CURRENT ABUNDANCE FOR THIS STOCK

DATE: 4/2/1981
TIME: 10:2

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 2482854.186
PRE-EXPLOITATION ABUNDANCE = 2482854.186
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 2669.256

THE QUOTA IN FUTURE YWARS IS 2669.256 692.728 1788 1788 1788

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEQ	REPLACEMENT YIELD	CURRENT NET REP
1979	0	2.4829E6	166.51	100.0	0.E0	1.0000
1980	1	2.4802E6	166.33	99.9	2.5578E2	1.0001
1981	2	2.4797E6	166.31	99.9	2.9757E2	1.0001
1982	3	2.4783E6	166.21	99.8	4.3990E2	1.0002
1983	4	2.4769E6	166.11	99.8	5.6840E2	1.0002
1984	5	2.4757E6	166.03	99.7	6.8445E2	1.0003

FORWARD KILLS FOR NORTHERN STRIPED

PRE EXPLOITATION IS ASSUMED TO EQUAL CURRENT ABUNDANCE FOR THIS STOCK

DATE: 4/2/1981
TIME: 10:2

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 918217.0972
PRE-EXPLOITATION ABUNDANCE = 918217.0972
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 440.16

THE QUOTA IN FUTURE YWARS IS 440.16 266.192 280 280 280

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEQ	REPLACEMENT YIELD	CURRENT NET REP
1979	0	9.1822E5	166.51	100.0	0.E0	1.0000
1980	1	9.1778E5	166.43	100.0	4.2221E1	1.0000
1981	2	9.1755E5	166.39	99.9	6.3679E1	1.0001
1982	3	9.1734E5	166.35	99.9	8.4387E1	1.0001
1983	4	9.1714E5	166.32	99.9	1.0310E2	1.0001
1984	5	9.1696E5	166.29	99.9	1.2001E2	1.0001

Appendix IV : Sample output for program FOR.

FORWARD KILLS FOR CENTRAL TROPICAL STRIPED

DATE: 4/2/1981
TIME: 10:4

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 3794799.6
PRE-EXPLOITATION ABUNDANCE = 3796399.81
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 141.48

THE QUOTA IN FUTURE YWARS IS 141.48 47.16 545 545 545

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEG	REPLACEMENT YIELD	CURRENT NET REP
1979	0	3.7948E6	166.44	100.0	1.5351E2	1.0000
1980	1	3.7948E6	166.44	100.0	1.5236E2	1.0000
1981	2	3.7949E6	166.45	100.0	1.4227E2	1.0000
1982	3	3.7945E6	166.43	100.0	1.8088E2	1.0000
1983	4	3.7941E6	166.41	99.9	2.1577E2	1.0001
1984	5	3.7938E6	166.40	99.9	2.4731E2	1.0001

FORWARD KILLS FOR SOUTHERN STRIPED

PRE EXPLOITATION IS ASSUMED TO EQUAL CURRENT ABUNDANCE FOR THIS STOCK

DATE: 4/2/1981
TIME: 10:4

THIS FUNCTION PROJECTS THE POPULATION AHEAD IN TIME ACCORDING TO THE DENSITY DEPENDENT MODEL AND PROVIDES ESTIMATES OF THE RATE OF RECOVERY OF THE POPULATION.

THE PARAMETER VALUES USED IN THIS RUN ARE:
PRESENT ABUNDANCE = 2830580.406
PRE-EXPLOITATION ABUNDANCE = 2830580.406
RMAX = 0.04
THE EXPONENT = 2.4
THE CORRESPONDING MNPL LEVEL = 60.05517699 PER CENT

THE KILL IN 1979 IS: 57.64

THE QUOTA IN FUTURE YWARS IS 57.64 18.864 1127 1127 1127

THE RESULTS ARE:

YEAR	YEARS AHEAD	ESTIMATED ABUNDANCE	PER CENT OF MNPL	PER CENT OF NEG	REPLACEMENT YIELD	CURRENT NET REP
1979	0	2.8306E6	166.51	100.0	0.E0	1.0000
1980	1	2.8305E6	166.51	100.0	5.5332E0	1.0000
1981	2	2.8305E6	166.51	100.0	6.8129E0	1.0000
1982	3	2.8274E6	166.44	100.0	1.1427E2	1.0000
1983	4	2.8284E6	166.38	99.9	2.1130E2	1.0001
1984	5	2.8275E6	166.33	99.9	2.9893E2	1.0001

